REGIONAL AND STRATIGRAPHICAL GEOLOGY.

AMONG the latest memoirs published by the Geological Survey of Great Britain in 1908 are three dealing with familiar ground. Mr. C. Fox-Strangways writes on "The Geology of the Country North and East of Harrogate" (price 2*s.* 6*d.*), in explanation of Sheet 62. A geological map of the district round Harrogate is inserted as a plate in the memoir, and the photographic views, including the famous dropping well of Knaresborough, will interest visitors who may not be specialists. There is a chapter on the history and origin of the Harrogate springs, which are held to arise from independent sources in the hills west of the town, obtaining their chemical ingredients as they pass through the Lower Carboniferous strata towards the spots where they emerge. These strata are provisionally retained as Yoredale beds.

Messrs. A. J. Jukes-Browne and H. J. Osborne White, in explanation of Sheet 254, write of "The Country around Henley-on-Thames and Wallingford" (price 2*s.*). The colour-printed map (price 1*s.* 6*d.*) was issued in 1905, and a slight correction of it, as regards the zones of the chalk north of Henley, is given, on a somewhat reduced scale, in the memoir. The country depicted includes the well-known road that climbs from Henley to the woods of Nettlebed, and drops again over the face of the Chalk to the Thames alluvium at Benson. From Dorchester, one of the pleasantest of Oxford villages, we look back at the fine Chiltern scarp, through which the Thames cuts deeply. A map like this, with the section at its foot, explains a delightfully varied piece of country. The memoir hardly directs sufficient attention to the interest of the various gravels and to the problems of pebble-distribution in connection with the present valley, but the facts can, of course, all be found in Mr. White's chapters on the superficial deposits, where numerous references to other works are given. Mr. White shows how subaërial wasting (p. 79) has been going on here since Oligocene times, so that the pebble gravel of the Chiltern slope can have no definite age assigned to it. He regards the exotic pebbles, such as those of quartzite, that occur in the "plateau gravel" (p. 85), as derived from the older "pebble gravel," and as "carried into the region of the Upper Thames basin long before the commencement of the Pleistocene 'Ice Age.'"

That energetic writer, Mr. A. J. Jukes-Browne, has also prepared the memoir on "The Country around Andover" (price 1*s.* 6*d.*), accompanying Sheet 283. The map (also price 1*s.* 6*d.*) was issued in 1905. In this area we are on the great undulating plateau of chalk, over which men still travel fast—often far too fast—on the way from Basingstoke to Bath. The beautiful little valley of Kingsclere adds variety in the north-east, where a breached anticline exposes Selbornian Upper Greensand. This fold is illustrated by a section on the map itself. The uninitiated, however, must remember that the exaggeration of the vertical scale, harmless enough in the right-hand portion, produces an unfortunate effect where the dip changes rapidly on the left, the Chalk appearing as if compressed to one-third of its thickness at the outcrop. The memoir deals with the Cretaceous zones in a manner that was impossible when the area was first surveyed in 1857. In conclusion, it touches on springs and water-supply, questions of special importance in such a region.

A fourth memoir, on "The Country between Newark and Nottingham," by Messrs. Lamplugh, Gibson, Sherlock, and Wright (price 2*s.* 3*d.*), describes Sheet 126, published in 1908. There is very little glacial drift in this part of the Trent valley, and the surface is mainly occupied by Triassic strata. The chief point of interest for the dwellers in this agricultural country lies in the fact that the Coal-measures, which crop out west of Nottingham, probably underlie the whole of it. Indications of concealed faults, known already from subterranean workings, are shown by orange lines upon the map. The longitudinal section below it is properly non-committal as to the concealed coalfield; but the Clifton Colliery has already burrowed under the Trent, and the whole land eastward may yet become a "black country," with the Trent as its convenient waterway. The soils of the district are interestingly referred to on pp. 96–7.

In the Proceedings of the Geologists' Association, vol. xx. (1908), p. 390, Messrs. C. P. Chatwin and T. H. Withers describe the zones of the Chalk in the Thames valley between Goring and Shiplake, a district bearing on those recently examined by the survey. The work of these authors is, in fact, referred to in the Andover memoir. The united evidence shows that the higher zones of the Senonian were denuded away over a wide area in our Midlands before the deposition of the Eocene strata.

A special character was imparted to the later work of Mr. J. Lomas by the broad geographical outlook of the author. This is apparent in his description of the geology of the Berwyn Hills (Proc. Geol. Assoc., vol. xx., 1908, p. 477), which serves as a useful companion for any visitor to Llangollen. We may mention the account (p. 488) of the walls of the Dee valley, and their relation to former glaciers, as an example of the features here clearly brought before the reader.

In the *Jahrbuch d. k.k. geol. Reichsanstalt* for 1908, pp. 469–526, Dr. H. Reininger furnishes an interesting study of the Tertiary basin of Budweis, near the southern Bohemian border. He concludes that the plant-bearing beds were laid down in a considerable lake in Middle Miocene times between steeply falling walls of crystalline rock. The Alpine movements (p. 511) gave rise to the hollow in which the water gathered, despite the general resistance of the old Bohemian mass that surrounds the basin. Dr. Reininger points out that numerous fissures were produced in Bohemia by pressures of even later date, and that the basin of Budweis was probably uplifted with the southern Böhmerwald at some time later than the Miocene. Here we approach the edge of controversy, and once more look towards the Alps.

It is impossible to do justice, however, either in the study or the field, to the successive memoirs that appear on the tectonics of the Alps. In three numbers of *Petermann's Mitteilungen* (Bd. liv., 1908, Nos. 10, 11, and 12) Prof. Fritz Frech, of Breslau, has furnished a summary occupying forty-two pages, in which he endeavours to harmonise the views of various writers. Profs. Diener, Kilian, and Schardt have supplied descriptions of special districts, and Prof. Frech shows his fairness by a kindly reference (p. 223) to the gravitational theory of folding urged by Reyer. Emphasis is laid on the great faults that accompanied the folding in the eastern Alps (p. 256), such as the "Gailbruch," which manifested itself as late as 1346 in a terrific earthquake and a landslide, the huge scars of which can still be seen on the precipice of the Dobratsch as one leaves Villach for the south. Close at hand we find the region of the south Alpine Trias, a plateau-country cut up by vertical faulting. In his concluding sentences, Prof. Frech shows how the overfolded structure of the western Alps is connected with the dissimilar and broken structure of the east by districts, like the Brenner or the Radstädter Tauern, where both types lie near one another. This gives the Alpine chain an advantage over many other mountain regions; but the author points out (p. 282) that we may be led on from it to connect the folded ridges of Mexico with the faulted plateaus of Arizona and Utah, as manifestations of one and the same mountain-building process. The memoir is illustrated by photographic plates and sections.

Dr. Ampferer's paper on the Sonnwendgebirge, referred to by Prof. Frech in a footnote, appears in the *Jahrbuch der k.k. geologischen Reichsanstalt*, Band lviii. (1908), p. 281. Wähner has recognised certain "hornstone-breccias" intercalated among Jurassic radiolarian marls as evidences of overthrusts. Ampferer regards them as truly and evenly interbedded, and as resulting from the uplift of an eastern part of the sea-floor; the sediments already formed slipped down over the underlying slope of the Kossen beds, wrinkling themselves during this gravitational sliding. Denudation of the uplifted part by subaërial agencies set in, and the hornstone-breccias are evidences of this decay. The large blocks found in them may record actual landslips. Where the breccias are repeated, elevation and depression must have alternated. The Gosau beds were laid down unconformably on the surface due to this epoch of denudation. Features of this kind are, of course, noticeable both in the Carboniferous Limestone and in the Chalk of our own islands. The main interest of Ampferer's paper from a tectonic point of view lies in its acceptance of Reyer's doctrine of what may be called "contemporary gliding."

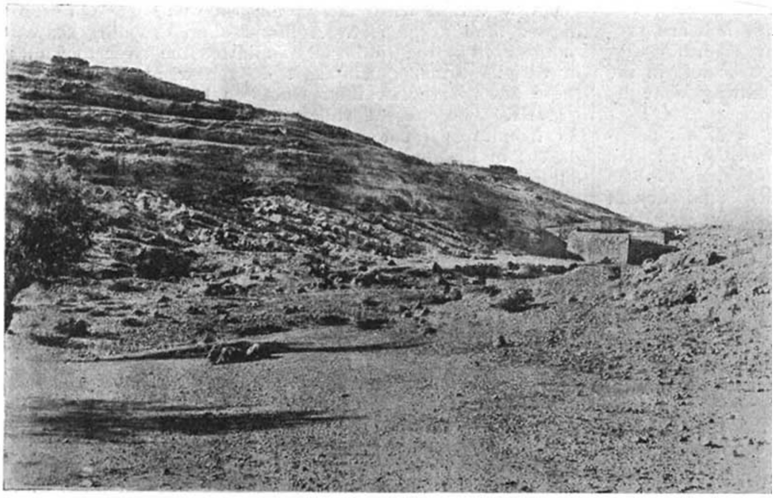

FIG. 1.—Unconformity of Sub-recent Conglomerates on Cretaceous Limestone, Kalhat, Coast of Oman, Arabia. (Photo. by A. v. Krafft.)

In the *Verhandlungen* of the same institute (1908, p. 326) Prof. Tornquist, of Königsberg, replies to Dr. Ampferer concerning the Flysch-zone in Allgäu and the Vorarlberg, and he very interestingly pictures the formation of a submarine overthrust during the growth of the Flysch deposits. The Alps had even then begun to rise, and the limestone "klippe" of Allgäu was thrust over the earliest beds of Flysch and became entombed in those that were still forming. Tornquist opposes Ampferer's comparison of the phenomena with those brought about by landslides, and asks us (p. 331) to consider the effects of earth-movements on unconsolidated sediments still beneath the sea. He would like to explain, on the same principles, the "klippen" studied by Uhlig in the Carpathians. Even in the submarine processes described there seems to be a good deal that is akin to landsliding, but Tornquist makes the folding and the accompanying gliding contemporaneous with the Flysch itself.

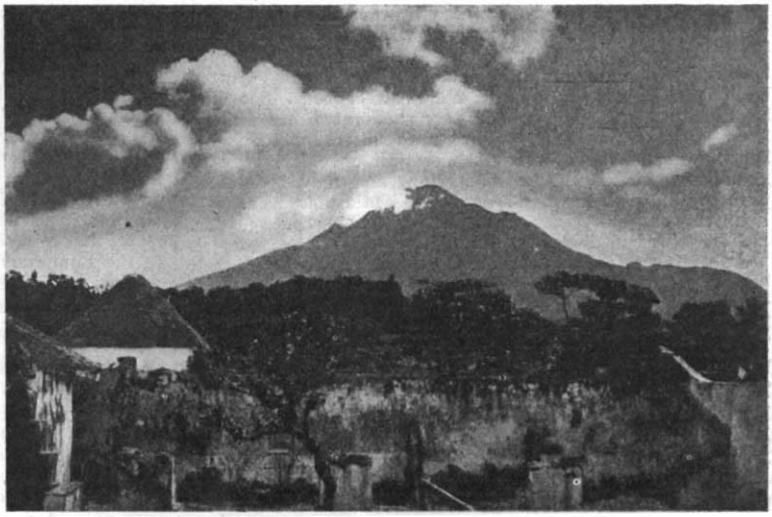

FIG. 2.—Extinct Volcano of Mount Iraya, in Batan Island, Philippines. (Photo. by Worcester.)

From these closely criticised regions it is refreshing to come out with Dr. W. F. Hume into the unknown south-western desert of Egypt (*Cairo Scientific Journal*, vol. ii., 1908, pp. 279 and 314). His paper is meant for the general reader, and its style and contents would make an admirable lecture. A great southward extension of Eocene strata has been discovered by the author. His remarks on wind-erosion (p. 318) show, as one might not at first sight expect, that sand is absent where the signs of erosion are intense. The cutting agent finds no resting place, but is hurried over the edge of the desert plateau to fall in great sand-slopes towards the plain and to fill up valleys that are there sheltered from the wind.

In the Memoirs of the Geological Survey of India, vol. xxxiv., part iv. (1908), we have another of those broad surveys that are still possible in Africa and Asia, and that recall the days of von Buch, Murchison, or Darwin. Mr. G. E. Pilgrim has had the fortune to report on the geology of the Persian Gulf and the adjoining portions of Persia and Arabia. He too has felt that in science it is good to be a king,

> And ride in triumph through Persepolis.

Mr. Pilgrim provides photographic views of barren landscapes, and a geological map, in which are correlated his own observations and those of his predecessors. Marine beds occur up to the Messinian and Pontian stage, *i.e.* into what are generally regarded as Pliocene times (p. 25), and the Persian Gulf is attributed to denudation acting still later on a mass that became upraised in some places 9000 feet above the sea. Then came a Pleistocene submergence, followed by still more recent elevation, of which we have evidence in the modern shorelines.

Mr. H. G. Ferguson describes the small Batanes Islands, the northern outliers of the Philippine group towards Formosa (*Philippine Journal of Science*, vol. iii., 1908, p. 1). The basal rock is a pre-Miocene volcanic agglomerate, and the islands are thus really volcanic piles. Miocene limestones were formed across them, and became uplifted to 275 metres above the present sea. The frequent earthquakes are correlated (pp. 14 and 24) with a fault that is possibly traceable into Luzon. Volcanic activity continued in the group during the time of uplift, and Mount Iraya, in the north of Batan, has quite a modern aspect.

That excellent observer, Mr. A. J. C. Molyneux, of Bulawayo, describes part of the Bechuanaland Protectorate in the Proceedings of the Rhodesia Scientific Association, vol. vi. (1906), p. 73. This district links itself interestingly with that reported on by the Survey of Cape Colony near Kimberley, and the author traces its Waterberg and Karroo strata also north into Rhodesia (p. 86). But should he write both "Karroo" and "Karoo" on successive pages? The basalts of the Victoria Falls area are correlated with the Tuli lavas of Bechuanaland and with the volcanic rocks of Stormberg age farther south.

Passing to America, Mr. E. Otis Hovey has described for the first time the general geology of the western Sierra Madre in the State of Chihuahua, Mexico (Bull. Amer. Museum Nat. Hist., vol. xxiii., 1907, p. 401). The region is likely to be developed from a mining point of view, but is mainly given over to stock-raising. It owes its relief to denudation, acting on a plateau of Cretaceous limestone and andesite, on which lava-flows of basalt and rhyolite, with additional andesite, have broken out. Important post-Cretaceous intrusions of granite occur. The broad, enclosed basins of the plateau, which are well illustrated, became filled up by débris, largely wind-borne, and sandstones and conglomerates arose which almost obliterated the original relief. The present tendency is still towards the filling of such basins by the crumbling of outstanding relics of the older surface under the action of an arid type of denudation; but rivers have cut modern cañons through the mass, and are producing a new series of relief-features. It is interesting to note (p. 422) that hanging valleys have been left in the canon of the Aros "by the more rapid cutting done by the great stream."

Mr. A. Gibb Maitland chose as the subject of his presidential address to the Australasian Association for the Advancement of Science in 1907 "The Geology of Western Australia." This address forms a convenient summary of recent work, now that it has been published by Mr. Bristow, Government printer in Adelaide. Attention is directed (p. 10) to the attractions offered by the Cambrian beds of the Kimberley district, from which Hardman gathered an unlocalised Olenellus in 1883. The glacial boulder-bed east of the Kennedy Range (p. 16) is of early Carboniferous age. Laterite, in part pisolitic, occurs throughout Western Australia (p. 24), and is recognised as resulting from the decomposition and re-consolidation of the underlying rocks *in situ*. These rocks are commonly granites. Secondary silica converts some types of the laterite into quartzites; others pass over into bauxite. Here once more we are in face of the most interesting problem of weathering presented to us in the tropics. The laterite has been cut through by denuding agents, and some of it may be of early Cainozoic age, while in other places it is still forming.

Among papers dealing with special systems rather than with regional geology we may note one by Messrs. W. G. Miller and C. W. Knight on the Grenville Hastings unconformity (Sixteenth Report, Bureau of Mines, Canada, 1907, p. 221), in which it is urged that the Hastings series in Ontario and Quebec has an independent position, being unconformable to the underlying Grenville series, and not merely an altered portion of that series. The Laurentian gneiss is intrusive in the Keewatin series and in the overlying Grenville series in south-eastern Ontario. The Hastings series is styled Huronian by the authors.

Sir T. H. Holland (Records Geol. Surv. India, vol. xxxvii., 1908, p. 129) shows that the Blaini formation of Simla, in which he now finds well-striated boulders, need no longer be correlated with the Talchir beds, but may be much older, since glacial conglomerates are known from various horizons. The unfossiliferous sediments below it, hitherto regarded as Permian or older, may be actually as old as the pre-Cambrian, and may be classed with the author's Purana beds of the peninsular area.

In the same Records, vol. xxxvi. (1907), p. 23, Mr. H. H. Hayden discusses the age of the Gangamopteris beds of Kashmir, and furnishes good photographs of their occurrence in the field. These beds are "not younger than upper Carboniferous," since equivalents of the Fenestella-shales of Spiti overlie them.

A very interesting paper on desert conditions and the origin of the British Trias was contributed by the late Mr. J. Lomas to vol. x. of the Proceedings of the Liverpool Geological Society (1907), p. 172. Personal observations in Africa were utilised, and the author lost his life, as already recorded in NATURE (vol. lxxix., p. 226), while extending his researches in an area from which he hoped to gather much. Prof. Bonney, who has so long studied the Triassic pebble-beds, has commented on Mr. Lomas's conclusions in the *Geological Magazine* for 1908. Our knowledge of the marine Trias of Europe is increased by Dr. F. v. Kerner, who publishes a considerable paper on the southern border of the Svilaja planina in Dalmatia (*Verhandl. d. k.k. geol. Reichsanstalt*, 1908, pp. 259–289). In the uppermost zone there are reefs formed by calcareous algæ, with intervals of ordinary sediments between them, where detritus from earlier volcanic rocks was washed in among the limestone-building organisms.

Coming to much more recent times, Herr B. Stürtz, of Bonn, has made a detailed study of the "Rheindiluvium" from Bingerbruck, near Mainz, downwards to the Netherlands (*Verhandl. d. naturhist. Vereins der preuss. Rheinlande u. Westfalens* for 1907, published 1908, pp. 1–91). He does not seem to take into consideration the older extension of the alluvium of the Rhine to the English coast, which many authors have looked on as a feature of late Pliocene times. He regards the old delta as beginning near the Ahr, midway between Coblenz and Bonn, at a time when the stream-bed was some 150 metres higher than at present. A broad plain dropping seaward to the area of the Netherlands allowed the river to wander in various arms, much as it does now in Holland, and these arms have left their traces in high-level "diluvial" gravels. The present valleys of the main stream and of its tributaries must have been deepened by 100 to 200 metres in Pleistocene and recent times. The effects of the damming up of the waters by the Scandinavian ice-front are discussed. The higher deposits of löss are, however, attributed to wind-action, while others were laid down in a glacial lake between the uplands and the ice.

G. A. J. C.

A REMARKABLE DEVELOPMENT IN X-RAY APPARATUS.

THE old induction-coil seems likely to have a serious rival in the new apparatus which Messrs. Newton and Co., of Fleet Street, are showing. This is the "Snook" Röntgen apparatus. The machine consists of a motor converter driven from the continuous current mains, and supplying an alternating current to a step-up transformer. This transformer is immersed bodily in a galvanised iron tank filled with an insulating oil, the whole being hermetically sealed. The voltage at the secondary terminals of this transformer amounts to as much as 70,000–100,000, and can be regulated as required by means of an adjustable resistance in the primary circuit.

The most important adjunct is a mechanical rectifier, consisting of a rotating commutator of special design carried on the axle of the motor converter; thus it cannot get out of step, and, what is perhaps of as great importance, it requires no attention. The commutator when once adjusted in proper phase produces a very nearly unidirectional current, although, of course, perfection in this respect is unattainable, as will be realised when it is remembered that the current from the converter cannot be a simple harmonic one. Be this as it may, the rectification is very successfully made, and the simplicity of the device commends it when compared with the very troublesome valve tubes which must so frequently be employed for heavy X-ray work.

With regard to the efficiency, a current of 25 amperes at 200 volts in the primary circuit yields 60 milliamperes or more through an X-ray tube of 3 or 4 inches spark. Having inspected the apparatus while in action, we may state that we consider it to be a most efficient addition to the numerous arrangements available to the present-day worker in X-rays.

RECENT PAPERS ON MARINE ANIMALS.

AMONG papers on various groups of marine animals in serial and other publications which have recently reached us, reference may first be made to a fasciculus of "Illustrations of the Zoology of the Indian Survey Ship *Investigator*," containing plates devoted to new and other species of fishes, entomostracous crustaceans, and molluscs. In addition to certain deep-sea forms, the fishes include two species of skate, described by Dr. R. E. Lloyd in 1906, several kinds of stalked barnacles are figured, and the molluscs include seven species, described by Mr. E. A. Smith in the year already mentioned, of which the shells are for the first time depicted.

Reverting to fishes, we find Messrs. Gilchrist and Wardlaw Thompson contributing to the second part of vol. vi. of the Annals of the South African Museum one paper on the local Blenniidæ and another on various species from the Natal coast. The blennies have hitherto been very